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Training infectious diseases senior residents during COVID-19: The impact and the lessons learnt

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ABSTRACT

Background: The COVID-19 pandemic had major impact on the training of Infectious Diseases (ID) residents across the globe. They were part of the frontline staff, while at the same time training to be ID physicians. This study focused on identifying their capability, i.e. the ability to adapt existing competencies to new situations, which is now recognised as an essential element of professional practice.

Aim: This study explored what ID residents learnt and how they learnt as they adapted to working in this unpredictable and challenging COVID-19 pandemic.

Methods: This qualitative explorative study was based in the Infectious Diseases Senior Residency Programme across three training institutions in Singapore. Individual semi-structured interviews were conducted. Data were analysed using a template analysis technique.

Results: Nine ID residents participated in this study. They learnt to engage with uncertainty in a meaningful way by relying on prior training and rapidly learning how to most effectively learn (metacognition). Learning was enhanced by collaboration between multidisciplinary health professionals, strong leadership and intrinsic motivation from personal interest in ID. They learnt through observing how senior faculty approached and managed the COVID-19 situation.

Conclusion: When learning for future capability in a rapidly evolving situation, role-modelling and mentoring are essential as available information resources may still not provide the learning from skilled doctors with actual experiences managing complex, uncertain situations.

KEYWORDS

COVID-19 pandemic; infectious diseases residents; capability

Introduction

Global disasters, such as infectious diseases (ID) pandemics, place enormous burdens on healthcare services to deliver core medical care that require multidisciplinary expertise and skills (Ashcroft et al. 2021). These disasters are rapidly changing complex environments with high levels of uncertainties where temporal occurrences and specifics are often 'surprise events' (Hermelin et al. 2019). The novel coronavirus disease 2019 (COVID-19), which was declared a pandemic by the World Health Organisation on 11 March 2020, is no different. Urgent overhaul of routine hospital practices resulted in the diversion and deployment of all available residents-in-training to pandemic preparations, either at hospital and/or national levels. This was similarly reported during the severe acute respiratory syndrome (SARS) outbreak in 2003 (Sherbino and Atzema 2004).

Residents form the bulk of the frontline personnel in hospital settings. They train in workplaces as part of their competency-based training programmes where curricula are based on outcomes (Frank et al. 2010; Sulton et al. 2017). Competency refers to what residents are able to do with regards to knowledge, skills and attitudes (Fraser and Greenhalgh 2001). Capability refers specifically to the extent to which residents are able to integrate and apply these knowledge, skills and attitudes to adapt to changes; not just in focused and familiar settings but also in novel, changing

Practice points

- The ability to engage with uncertainty in a meaningful way helps to deal with unfamiliar, rapidly changing situations.
- Working collaboratively and strong leadership allow negotiations and provide reassurance during uncertainty.
- Role-modelling and mentoring is key when educating for capability.

and complex circumstances (Stephenson 1998; Neve and Hanks 2016). Residents should be able to appraise new, changing situations as a whole and adapt their existing competencies to prioritise, integrate and comprehend the various available resources to identify novel solutions (Fraser and Greenhalgh 2001). Capability is recognised as an important element of professional practice.

The occurrence of the COVID-19 pandemic is an excellent example of a rapidly changing, complex environment with high levels of uncertainties. The complexity and inherent aspects of surprise (e.g. the evolving specifics of disease) meant that it would not be possible to immediately determine the best possible solutions (Hermelin et al. 2019). Also, in novel infectious disease pandemics (unlike natural disasters, e.g. earthquakes), the experience has to be built up as the event unfolds, as in the beginning, there

are many unknowns about the disease. Expertise is then developed as the situation evolves and more information becomes available. However, as anecdotal and empirical data become available, it isn't always clear which new-found knowledge is reliable and which knowledge can be applied to one's own situation. This is where healthcare workers' capability to use their experience, prior knowledge and skills and ability to learn is essential. Pandemics like COVID-19 need clinicians who are able to creatively 'think outside the box' to identify and address atypical, challenging problems.

Research on disaster preparedness, especially due to natural causes such as earthquakes, show that lessons from disaster response can be translated back to curriculum and practice. The article published by Hermelin et al. (2019) demonstrates how simulation sessions can be incorporated into the existing training curriculum. Building on knowledge from their existing disaster management domains (e.g. chemical spills), they developed simulation to educate residents on assessment and identification of a rapidly unfolding disaster situations by restructuring, developing and reflecting on their existing mental models to better cope with uncertainty, complexity and the unexpected. Another recent study is the work of Walker et al. (2020) who created an interactive mass casualty incident (MCI) curriculum for emergency medicine residents to train them for the unexpected and learn through experiences. However, in infectious diseases pandemic preparedness, such educational tools are lacking.

We explored what ID residents learnt and how they learnt while working in the unpredictable and challenging outbreak of a novel, highly infectious disease, using their previously gained knowledge, skills, and experiences. The aim of this research is to provide insights obtained from residents' current experiences in order to inform us on how to better educate future residents for capability within the existing competency-based curriculum, not just for future pandemics but also for their eventual roles as consultants in the ever-unpredictable field of medicine. These insights can potentially aid other programs in a similar direction.

Methods

Study setting

This study was based in the Infectious Diseases Senior Residency Program (ID SRP) across three training institutions in Singapore, namely the National University Hospital, the National Centre for Infectious Diseases and the Singapore General Hospital. The ID SRP is a 3-year competency-based training program accredited by the Accreditation Council for Graduate Medical Education-International (ACGME-I) in 2013 and its Next Accreditation System-International (NAS-I) in 2017. All selected ID senior residents have previously completed a 3-year structured, clinical foundational training under the Internal Medicine Junior Residency Programme.

Participants

The participants consisted of all 17 actively training ID residents in the three institutions. They were first to third year

ID residents with varying levels of ID proficiency corresponding to their level of training. In addition to routine ID-related work, they had been directly involved in managing the COVID-19 pandemic. Their COVID-19 specific duties (clinical and non-clinical) included at least one month of providing day-to-day direct patient care and helping senior faculty with response planning, workflow/protocol development, research on the emerging infectious disease, and literature review/presentation of the rapidly emerging data. Participants were invited by email invitations. Participation was voluntary and participants were allowed to withdraw at any time during the study. The identities and responses of all the participants were kept strictly confidential.

Design

A qualitative approach using content analysis was used. This exploratory study was based on inductive reasoning where the investigator analysed the collected data and developed meaningful conclusions that answer the research questions (Bengtsson 2016). Our methodological approach fitted well with our constructivist research paradigm which emphasised multiple, varied perspectives and the importance of investigator interpretations (Drisko and Maschi 2016).

Data collection

Individual semi-structured interviews were conducted by the principal investigator (PI) and co-investigator (Co-I) based on a structured guide in English (the first language of the participants) *via* video conferencing software Zoom to maintain social distancing. All interviews were audio-recorded, anonymised and lasted approximately 30-50 min each. Data collection occurred until the investigators deemed data sufficiency, where codes identified appear to manage the new data without needing further modifications (Varpio et al. 2017).

Data analysis

The transcripts were analysed using a template analysis technique. *A priori* themes were first defined (Table 1) based on the conceptual framework for capability-based portfolio assessment as described by Sturmberg and Farmer (2009), followed by development of an initial coding template. This included grouping identified themes into smaller groups of higher-order codes, then studying and defining these hierarchical relationships.

The codes and themes were revised and adapted accordingly based on insights from the subsequent analysis. The final coding template was applied to the full data set.

The PI and Co-I first reviewed the transcripts and performed the analysis separately. This was followed by discussions between investigators where consensus was

Table 1. A priori themes.

Engage uncertainty in a meaningful way
Collaborative working
Role modelling and leadership
Role and perception of role as Infectious Diseases Senior Residents

obtained (Bengtsson 2016). The investigators ensured the analysis was not systemically distorted by their own assumptions and preconceptions through consistent quality and reflexivity checking (Brooks et al. 2015). Additionally, the themes generated from the analysis were sent to the participants for feedback to enhance data credibility (Frambach et al. 2013).

Reflexivity

The PI held the position of Program Director in one of the training institutions and was in charge of planning and ensuring the quality of educational strategies/activities within the training program. The Co-I held the position of Associate Program Director for the Internal Medicine Junior Residency Program in the same institution as the PI. The Co-I interviewed all the participants from the PI’s institution. A reflexivity diary was also kept by PI to reflect on the process as well as her influence and role in this study.

Ethics

Ethics approval was obtained from the National University Hospital Institutional Review Board (NUH IRB Reference No. 2020/01412).

Results

Nine ID residents participated in this study (Table 2). The interviews were conducted between February and March 2021, and occurred approximately one year after Singapore reported its first case of COVID-19 on 23 January 2020. Four dominant themes were generated as illustrated in Figure 1.

Table 2. Gender and year of training of participants.

Gender	Male	5
	Female	4
Year of training (at time of interview)	1	1
	2	5
	3	3

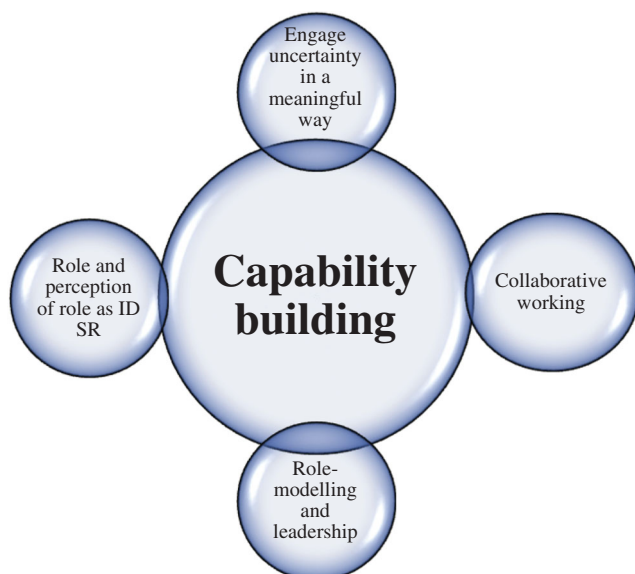


Figure 1. Summary of the four dominant themes identified.

Engage uncertainty in a meaningful way

All participants experienced elements of fear and anxiety when providing care for COVID-19 patients early in the outbreak, largely resulting from the paucity of knowledge about the disease which was novel with many unknowns (e.g. infectivity rate, mode of transmission). This was exacerbated by the vast amount of rapidly emerging information about the disease from multiple sources which was contradictory at times, ranging from journal articles to multiple revisions of hospital/national infection control protocols. Furthermore, considered as part of the team of ‘experts’ in this ID pandemic within the hospital setting, various healthcare professionals were looking to them for guidance even though they were still residents-in-training who are themselves unfamiliar with this novel disease.

In such situations, the participants learnt that being able to remain calm was crucial to avoid further cause for alarm in an already uncertain complex situation. They tended to first manage the situation themselves by assessing the situation as whole, going back to basics and falling back on their prior training to try to adapt their existing knowledge and skills to devise a solution.

When faced with such a scenario, knowing that I have some background knowledge and experience to make that decision helped. I think just taking a step back and knowing that people are dependent on my decision, helped me to think about things clearly

Participant 5

If the situation was beyond their level of expertise, they would escalate to a senior faculty and ask for help accordingly. All participants agreed that the way they approached a situation tended to depend on their level of training (which corresponded to the amount of prior experiences and confidence level in managing uncertainties), the environment, time factor and urgency of the situation.

Their learning was further enhanced by observing how senior faculty approached and managed the patients, ranging from mild presentation of symptoms to severe and complicated requiring intensive care monitoring. This included watching them: 1) demonstrate clinical skills to assess different patient risks, 2) articulate expert thought processes on management of patients and, 3) apply evidenced-based medicine in clinical practice based on their interpretation of available data on COVID-19.

Additionally, the use of workflows and protocols to guide approaches and management of COVID-19 patients helped the participants manage most of the potential uncertainties. The workflows and protocols were rapidly developed and revised as new/more information emerged, and provided step-by-step formulaic clinical responses to COVID-19. The documents provided the reassurance that they were doing the right thing, yet flexible enough to allow adjustment of approaches based on individual case needs.

I’ve never read through so many protocols, so many versions during this pandemic. When everyone don’t know or is unsure about something, workflow actually works much better because everyone can refer (to it) and know the next steps. At the same time, it provides reassurance.

Participant 4

As the pandemic evolved, the participants learnt to acknowledge that it was acceptable to not know everything in this highly, complex uncertain situation. Rather, they needed to remain alert to and keep updated on new information on COVID-19 as it emerged, and familiarise themselves to as much of the available information as possible. This included sifting and critically appraising information from multiple sources as well as conducting research on the evolving disease. They learnt to build a rational approach to manage this uncertainty by changing or building their knowledge efficiently and judiciously as new information emerged.

There might be things that we do not know, but given the available information, we need to make a decision on how to proceed. If there's something that we don't know, can we do something about it? I think it is building on that knowledge, with regards to something that is new.

Participant 3

Collaborative working

The participants learnt that managing a crisis situation required expertise, knowledge and skills of interdisciplinary teams of healthcare professionals (medical and non-medical). They learnt that being able to collaborate and work effectively with others in a team was crucial for discussions and negotiations to agree on a reasonable way forward. This was because different individuals will have different goals and priorities based on prior experiences, professional expertise, roles of responsibility and personal perspectives of the situation.

Different consultants might have different viewpoints on treatment, infection control, or even available data. So, it was important to have that community of inquiry to put together all this data, make sense of and build on that and find out where we go from there

Participant 3

The participants also learnt that timely and honest communications that acknowledged the unknowns and uncertainty of the situation helped to build and maintain trust amongst the staff. After all, it was common for people to feel anxious and confused when multiple care processes or new treatments are being adopted rapidly with the constantly changing and rapid emergence of COVID-19 information from various sources. This included regular email disseminations at the hospital level, educational rounds and discussions at division, departmental as well as across institutions level.

Additionally, being a part of the ID division definitely helped them to better adapt to the evolving situation. As the senior faculty consisted of experts who had dealt with pandemics before (e.g. SARS and H1N1), as part of the team, the participants were able to observe and learn how the senior faculty conducted the discussions with the various other health professionals. Faculty role-modelled how they integrated different opinions and viewpoints that needed to be considered to identify potential conflicts of interest while working towards a common goal for the benefit of the hospital and patients.

Being able to work with people who have dealt with pandemics before, especially on an international level, made the difference,

in terms of how we learnt and adapted to the situation. I can just imagine, if I wasn't in ID but in another medical team, ... it's going to be quite daunting

Participant 5

Role modelling and leadership

As residents who will eventually take on the role of consultants, the participants learnt the importance of having good and strong leadership to bring the team together during this difficult time. An essential characteristic they identified was the ability to remain calm and composed, even under intense scrutiny and pressure, to prevent creating panic. Even though the senior faculty do not have all the answers, with others looking to them for guidance and decisions, they were still able to provide the necessary and appropriate directions, manage expectations and also respond to the situation in a timely manner. Our participants observed how the senior faculty listened to different opinions and articulated the risks and benefits of suggestions and viewpoints. They also observed how the senior faculty applied their past experiences dealing with pandemics (i.e. SARS) to the current situation so that they could identify similar patterns and find a close comparison, leading them to formulate solutions.

Everything kind of moved very smoothly and we all kind of came together to tackle the same problem. I suppose maybe I felt that way because of very strong leadership on a department and also division level

Participant 6

The participants identified *the willingness of the senior faculty to work alongside* with them to contribute and shoulder the increased clinical workload. Observing how the senior faculty were involved in doing the actual work on the frontlines, in addition to everything else that they were already doing with regards to pandemic response/planning, helped set the tone and provide the much needed motivation for the more junior members of the team, especially when there was fear and uncertainty.

Additionally, participants learnt the importance of how good leadership extended to managing the more junior members in the team to ensure they were supported both emotionally and in their clinical work as well as provided opportunities (e.g. research or protocol development). They expressed that the senior faculty regularly made efforts to reach out and connect with them at individual levels. They found the level of close supervision and guidance provided them with the confidence to deal with the uncertainties around COVID-19 as well as a safe learning environment where they were given flexibility and some level of autonomy to manage the patients.

I think it was how the division handled it. There were sessions for the residents to go through how the pandemic was handled, how things at the top were discussed, how the workflow was being worked on and came up with. The residents were involved even at the decision making level

Participant 7

Role and perception of role as infectious diseases senior residents

Being a trainee in a specialty which represented the main frontline during an infectious disease pandemic meant that

the participants had to step up and take on more duties in terms of maintaining the non-COVID aspect of ID clinical work in addition to COVID clinical work. This resulted in an early increase in responsibilities even though the majority of the participants were still relatively early in their ID specialty training when the pandemic started (5 were 6 months into training, 1 started during the pandemic). They expressed that being able to recognise and acknowledge their gaps and limitations as well as knowing when to ask for help was important.

So, to stay on top of the latest information, you have to be relatively self-disciplined to look up some of the new trials or some of the new data. The only thing really different about COVID was the pace at which new information was coming out.

Participant 1

The participants learnt that developing effective learning strategies was essential to help overcome their identified gaps and limitations. This was done *via* their own reading to catch-up on available data and to better understand the evolving pandemic. The educational rounds at division level, department and across institutional levels also contributed to their learning. For the participants who were still early in their ID specialty training, a lot of the reading was also focused on non-COVID core ID topics as well. While adapting to a new 'COVID-19 environment', they had to first adapt to being ID SRs in general and learning the non-COVID aspects of core ID. Importantly, they learnt that seeking help from seniors was crucial as extensive personal reading may still not provide all the answers, especially with situations like COVID-19, where a lot of knowledge and skills acquired were also attributed by prior experiences of managing actual pandemics.

A major contributor to the way the participants adapted was their intrinsic motivation. All of them had personal interests in pursuing ID as a career choice and was ever-looking forward to the perpetual challenges that infectious diseases bring. When the pandemic happened, it was viewed as their calling and they embraced the opportunity to be involved in this rare occurrence which not many residents could boast about during their years of training in ID. This, coupled with being in a team of experts who shared a similar passion for ID helped them flourish, despite the unfamiliarity and uncertainty of environment.

I mean, it was exciting... we join Infectious Diseases cause we want to do this kind of thing right? So it was very exciting in a way that it came so early

Participant 2

Discussion

Specialists and trainees in Infectious Diseases were among the main frontline personnel in the hospital setting during the COVID-19 pandemic. ID residents were provided with the rare and unique opportunity to be involved in a novel infectious disease pandemic on an international scale. Even though the practice of medicine is fraught with uncertainties on a daily basis, this pandemic brought forth a new, complex and rapidly changing uncertain situation on a whole other level. The results from this study identified four dominant themes on what ID residents learnt and how they learnt while working in this pandemic.

While providing care to COVID-19 patients amidst the paucity of knowledge about the novel disease with its many unknowns, the participants engaged with that unfamiliar and uncertain situation in a meaningful way by retrieving, linking and adapting their prior experiences and knowledge to the new circumstance. They learnt to identify the gaps in their knowledge and actively seek sources of information to bridge those gaps. As the pandemic evolved, they learnt to be more comfortable with uncertainty and embraced the challenges faced. They were able to make sense of the moment to moment changes in the situation to inform their actions by engaging in mindful practice (Epstein 1999; Fraser and Greenhalgh 2001). Additionally, as knowledge is constantly evolving and changing, gaps will be inevitable at any point in time. It is just not possible to know everything in medicine and thus, it was essential that our participants were able to acquire new knowledge and form links between unrelated information (Rees and Richards 2004). This resonates well with complexity theory's acknowledgement of the unknowable and uncertain in the COVID-19 situation, where we risk drowning in the vast amount of rapidly emerging information (Fraser and Greenhalgh 2001). By being able to identify and bridge any of their clinically relevant gaps, this self-directed learning enabled the participants to adapt to change, develop new knowledge and improve their performance as part of continuous professional development (O'Connell et al. 2014).

The residents also learnt the importance of working collaboratively when managing the pandemic, which required the expertise, knowledge and skills of an interdisciplinary healthcare team for best results. By combining expertise, health professionals learn from the experiences of others (Sawalha 2014). Additionally, it is often difficult to identify the 'ideal' interventions when a situation is rapidly evolving. Thus, collaboration allows discussions and negotiations to reach a consensus for the benefit of everyone. Outbreak situations also cause a lot of anxiety and as such, timely communications with widespread availability of the most updated information is key to allaying these anxieties (Perret et al. 2000).

As future ID specialists potentially leading the next pandemic, our participants reported learning the importance of good leadership during the pandemic. Capability is not just about knowledge and skills but also the ability to take appropriate and effective actions that positively impact co-workers during changing and unfamiliar circumstances. This involves judgements, ethics, the confidence to take necessary risks, and the commitment to learn from experiences (Stephenson 1998). Moreover, participants reported learning in a way that allowed dealing with cognitive complexity, i.e. 1) take a step back and view things from multiple, competing perspectives, 2) work in varied networks and relationships, and also, 3) rationalise the complexity for those they lead (McKimm and O'Sullivan 2016).

Another theme identified was their role and perceptions of roles as Infectious Diseases residents. A particular aspect identified unique to ID residents and contributed to the way they adapted to this pandemic was their intrinsic motivation, which significantly motivated a large proportion of their personal learning. Knowing one's own ability and having the confidence to admit when limitations are

reached allow them to take the appropriate and effective actions to formulate solutions in unfamiliar situations (O'Connell et al. 2014; Bochatay and Bajwa 2020). Additionally, capability is also an essential component of specialist practice. On top of their own specialisms, capable clinicians must have the confidence to apply their knowledge and skills to different changing situations, thus continuing to develop their specialist expertise long after their formal education (Cairns and Stephenson 2009). Hence, the pandemic provided the participants with the opportunity to continue to develop their specialist knowledge and skills by taking responsibility of their own education through personal learning (Stephenson 1998).

Common across all four themes was learning through observation. Role-modelling is a type of informal and unplanned process-oriented learning method where participants learn through direct observation of skilled doctors (Fraser and Greenhalgh 2001; Passi et al. 2013). It is a very powerful teaching method during workplace-based training for passing on skills, knowledge and values of the medical profession (Cruess et al. 2008). The massive scale and sheer unpredictability of this pandemic highlighted the importance of learning through observation as the various available information resources may still not provide the learning from experts who have actual experiences managing such global crises.

Limitations

There were several limitations identified in this study. The data collection occurred approximately one year after Singapore confirmed its first case. Since then, all the hospitals in Singapore had gradually resumed their healthcare services albeit with continued heightened vigilance. Similarly, all participants have resumed their pre-COVID training activities. Thus, there is a potential for increased risk of recall bias amongst participants, where the accuracy or completeness of their recollections may differ. To minimize this, the participants were encouraged to reflect and elaborate on their experiences and provide specific examples during interviews.

As the participants were only from the ID SRP, the experiences described may be unique to them as they were actively involved as frontline staff from the start of the pandemic, by the sheer nature of their specialty training. Thus, the experiences may not be transferable to other training programmes who were either minimally involved or not at all, or even to ID residents from other countries who might not have had similar experiences. However, as this study focused on capability building, the findings could still provide valuable insights on how and what residents need to learn when forced to adapt to unfamiliar, challenging situations, regardless of the pandemic.

Lastly, the findings may not reflect the experiences of the other healthcare professionals involved in the pandemic. It would have been useful to explore the viewpoints of the ID senior faculty who were supervising and guiding the participants during the pandemic or the experiences of residents from other specialties who were directly involved on the frontlines. The different levels of proficiency or specialty training could potentially affect what and how residents learn with regards to capability building. As such,

this study may be expanded next time to include other healthcare professionals.

Conclusion

In conclusion, ID residents learnt to engage with uncertainty in a meaningful way as well as the importance of collaborative working, good leadership and continued development of specialist expertise while adapting to this rapidly changing and uncertain COVID-19 pandemic. They learnt through observation of and close supervision by expert senior faculty.

These results suggest that when educating future residents for capability, role-modelling and mentoring are essential. What can be likely be improved is to engage in a conversation with the resident explicitly emphasising and discussing the behaviours that enable adaptation to changing circumstances and new challenges. Even though mentoring and role-modelling is currently being practiced in workplace-based training, a large number of senior faculty still fail to make their thought processes explicit and prompt reflective thinking.

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